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Substituting $\tan\alpha$ for m, we get

$$\frac{\pi}{2}\log\frac{1+\sin\alpha}{1-\sin\alpha}=\frac{\pi}{2}\log\frac{(1+\sin\alpha)^2}{1-\sin^2\alpha}=\frac{\pi}{2}\log\left(\frac{1+\sin\alpha}{\cos\alpha}\right)^2=\pi\log(\tan\alpha+\sec\alpha),$$

which result is quite as great as that given in the proposed problem.

MECHANICS.

188. Proposed by H. L. ORCHARD, M. A., B. Sc.

Spherical bubbles are rising in water. Find the relation between radius and velocity.

No solution has been received.

189 (Incorrectly numbered 190). Proposed by DR. L. E. DICKSON, The University of Chicago, Chicago, Ill.

Give the axiomatic principle of Physics which is equivalent to the theorem on the compound of two circles ("Graphical Methods in Trigonometry," MONTHLY, June-July, 1905).

No solution has been received.

190 (Incorrectly numbered 191). Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

A pole hinged at the bottom leans against the mid-point of a smooth rope suspended from two supports of equal height. Determine the position of equilibrium.

Solution by G. W. GREENWOOD, M. A., Dunbar, Pa.

Assuming that the figure is symmetrical with respect to the plane bisecting perpendicularly the segment determined by the two points of support, the tensions of the portions of the rope resolved parallel to the pole are equal in magnitude and direction, and must therefore be zero since the rope is smooth. Hence, the pole rests in a position perpendicular to the plane determined by the portions of the rope.

191 (Incorrectly numbered 192). Proposed by REV. J. H. MEYER, S. J., College of Sacred Heart, Augusta, Ga.

Find the velocity of a planet at a given point in its orbit.

Solution by G. W. GREENWOOD, M. A., Dunbar, Pa.

In the case of any central orbit we have $v=h/p$...(1), where p is the perpendicular from the pole upon the tangent at the point, and h is a constant. Also,

$$\frac{1}{p^2}=u^2+\left(\frac{du}{d\theta}\right)^2$$

and the equation of an ellipse, referred to a focus, is $lu=1+e\cos\theta$, where l is the semi-latus rectum.

$$\therefore \frac{1}{p^2}=\frac{2(1+e\cos\theta)-(1-e^2)}{l^2}=\frac{2u}{l}-\frac{1}{al}.$$

Hence (1) may be written $v^2=\frac{h^2}{l}\left(\frac{2}{r}-\frac{1}{a}\right)$.

Also solved by the Proposer.

DIOPHANTINE ANALYSIS.

132. Proposed by DR. OSWALD WEBLEN, Princeton University, Princeton, N. J.

From the numbers, 0, 1, 2, ..., 42, select seven, such that the 42 differences of these seven numbers shall be congruent (mod. 43) to the numbers 0, 1, 2, ..., 42. The differences may be both positive and negative.

Discussion by F. H. SAFFORD, Ph. D., University of Pennsylvania.

For convenience, let a circle be divided at 43 points, numbered consecutively from 0 to 42. Take any seven of these *numbers* and call the number of spaces between adjacent numbers *intervals*. The 42 differences of these seven numbers are obtained by taking the seven intervals together with all possible sums of *adjacent* intervals, two, three, ..., six, at a time. All differences may be considered positive by this method.

In order that the seven *numbers* may be a solution it is necessary and sufficient that the *intervals* shall possess the following properties:

(1) They shall be so selected that their sum is 43.

(2) They shall be capable of being arranged so that their sums, taken one at a time, two adjacent, three adjacent, etc., shall all be different. It will be evident that no interval can be 0, otherwise the differences will not be all distinct. Also 1 and 2 must be intervals, while if 3 is not an interval 4 must be, in order to provide for the differences 1, 2, 3, 4.

It is not difficult to write the totality of selections for (1), and there are 77 of them.

In permuting each of the 77 sets, it will be found by trial that no set will satisfy (2). Hence the problem is impossible.*

AVERAGE AND PROBABILITY.

160. Proposed by J. F. LAWRENCE, A.B., Professor of Mathematics, Oklahoma Agricultural College, Stillwater, Okla.

Two points are taken at random in a triangle, the line joining them dividing the triangle into two portions. Find the mean value of that portion containing the center of gravity.

No solution has been received.

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*There are solutions of the corresponding problem in which 43 is replaced by 3, 7, 13, or 21. See proposed problem 142. Ed. D.